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DEPARTMENT OF THE INTERIOR

UNITED STATES BUREAU OF MINES
JOHN W. FINCH, DIRECTOR

INFORMATION CIRCULAR

REVIEW OF ILLINOIS COAL-MINE FATALITIES FOR 1933

BY

A. U. MILLER

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By A. U. Miller[2]

INTRODUCTION

Since coal-mining records have been kept, reports of all mining States show that each year the lives of many workers have been sacrificed in the production of coal, and Illinois has contributed its share. Illinois reports for the 50 years 1882 to 1932, inclusive, show that 6,673 men were killed--6,121 underground, 340 in the shaft, and 212 on the surface. Of the fatalities underground, 3,116 were caused by falls of roof or sides, 1,111 by haulage, 630 by explosives, 577 by gas explosions, 139 by electricity, and 548 by other causes; 166 of the shaft fatalities were caused by falling down the shaft, 143 by the cage, and 31 by other causes; 108 of the surface fatalities were caused by railroad cars, 46 by machinery, and 58 by other causes.

Most of those engaged in mining are still of the opinion that it is an extremely hazardous occupation and that it is practically impossible to operate without accidents; however, students of safety in mining now believe that with the proper attention to accident prevention mining may be conducted with little, if any, greater accident rate than that of other supposedly hazardous industries. There is no mystery connected with accidents in mining; reports show that the majority are due to two main causes, falls of roof and sides and haulage. Mining companies in Illinois, as well as in other States, have proved in the past few years that the hazards of mining, like those of other industries, can be controlled to a large extent and the mines operated with few if any accidents, provided a great enough effort is made by employer and worker.

Although the past accident rate of Illinois may compare favorably with that of other mining States it is higher than it should be; the fact that 6,673 men (an average of 133.46 per year) were killed in and around the mines of the State between 1882 and 1932 indicates that accident prevention should receive more consideration in the future than in the past.

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[1] The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6813."

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As it is only through knowledge of the causes of accidents that intelligent steps can be taken to prevent their recurrence, reports on fatalities in Illinois mines have been reviewed for the calendar year 1933 in the hope that the information may assist operators and workers in preventing fatalities from similar causes in future.

Through the courtesy of James McSherry, director, State Department of Mines and Minerals for Illinois, it was possible to study the fatal injuries reported by the district inspectors for 1933. These reports show that 71 fatalities occurred in the State during the year; 59 (83.1 percent) occurred in mines that ship by railroad and 12 (16.9 percent) in small local mines. Tables 1 and 2 list the fatalities according to causes and occupations.

TABLE 1. - Fatal injuries during 1933 by causes

Underground fatalities	Number of fatalities	Percentage of total number of fatalities
Falls of roof	36	50.7
Falls of face or rib coal	9	12.7
Mine cars	8	11.4
Coupling cars	2	2.8
Locomotives	2	2.8
Electricity	3	4.2
Gas and dust explosions	1	1.4
Mine fires	----	----
Explosives	----	----
Mining machines	1	1.4
Loading machines	----	----
Suffocation (other than fires or explosions)	1	1.4
Animals	1	1.4
Falling objects	----	----
Flying coal from shots	1	1.4
Shaft	1	1.4
Falling down shaft	2	2.8
Cage	----	----
Miscellaneous	----	----
Top labor	3	4.2
Total	71	100.0

Table 1 shows that falls of roof rank first with 36 fatalities (50.7 percent of the total number), falls of face and rib coal second with 9 fatalities (12.7 percent), mine cars third with 8 fatalities (11.4 percent), and electricity fourth with 3 fatalities (4.2 percent).

TABLE 2. - Fatal injuries during 1933, by occupation

Occupation	Number of fatalities	Percentage of total number of fatalities	Occupation	Number of fatalities	Percentage of total number of fatalities
Examiners	1	1.4	Cagers	----	-------
Conveyor loaders ..	10	14.1	Electricians	----	-------
Miners	20	28.2	Pumpers	----	-------
Mining machinemen .	9	12.7	Drillers	----	-------
Loading machinemen.	1	1.4	Superintendent		
Motormen	2	2.8	or owner	2	2.8
Trip riders	7	9.9	Mine manager	----	-------
Drivers	2	2.8	Face boss	----	-------
Trappers	----	-------	Motor or parting		
Tracklayers	2	2.8	boss	----	-------
Timbermen	6	8.5	Shift boss	1	1.4
Laborers	2	2.8	Miscellaneous ...	1	1.4
Shot firers	2	2.8	Top labor	3	4.2
			Total	71	100.0

Table 2 shows that hand-loading miners rank first with 20 fatalities (28.2 percent of the total number), conveyor loaders second with 10 fatalities (14.1 percent), mining machinemen third with 9 fatalities (12.7 percent), trip riders fourth with 7 fatalities (9.9 percent), and timbermen fifth with 6 fatalities (8.5 percent).

Information obtained in the review of the reports and evidence at the coroners' inquests have been summarized for each fatality.

Fatality 1

A miner's left thigh was crushed so badly by a fall of slate that it was necessary to amputate the leg; blood poisoning and a lung abscess developed, causing his death 40 days later.

According to the report the place was well-propped, but a piece of slate about 5 feet wide, 7 feet long, and 8 inches thick in the center swung two props and fell on the deceased. While the room was supposed to be well-propped, the fact that the slate swung the props is evidence that it was not secured properly. Doubtless, closer inspection of the slate by the vibration method would have revealed the necessity of taking it down, instead of trying to secure it with props.

Fatality 2

A trip rider's left leg was crushed between the locomotive and the rib; he died as a result of the injury.

The report on this fatality states that the trip rider was on the rear end of a gathering locomotive. While passing over a room switch the front trucks of the locomotive went straight while the rear trucks "split" the room switch, causing the rear trucks to start in the room switch and thereby derail the locomotive. The trip rider was thrown off the locomotive and his leg crushed between the rear end of the locomotive and the rib.

The report does not state whether or not the room switches are provided with switch throws. When switch throws are provided at room latches and the throws and latches maintained in good condition, there is little likelihood that rolling stock will "split" switches and cause derailments like the one resulting in this fatality. If switch throws are provided at room latches in this mine, closer inspection of the locomotive and track might reveal some defect, although the report states that the switch and the wheels and flanges of the locomotive were in good condition. Another possibly important factor, not mentioned in the report, is the position of the trip rider on the locomotive. The writer has often observed trip riders sitting on moving locomotives with nothing to which they may hold and their feet hanging down alongside the locomotive; in this position a sudden lurch of the locomotive is likely to throw a trip rider off and cause a serious accident, if not a fatality.

Fatality 3

A miner, moving dirt with a tractor at a strip mine, was killed by a piece of rock falling on his head; the rock was thrown by a shot in the strip pit.

According to information in the report, the deceased was about 150 feet away from the shot when he was hit by the rock. Whether he knew the shots were being fired is not stated in the report; it should be the duty of those in charge of such work to see that all employees in and around the pit are at a safe distance from shots when they are fired.

Many companies engaged in open-pit mining, whether coal, rock, or metal, have a system of signals to indicate when shots are going to be fired. When these signals are given, all employees are required to move to a safe distance; where employees cannot move to a safe distance, suitable buildings should be provided for their protection until after the shots are fired.

Fatality 4

A trip rider was killed on the entry by a fall of slate. While two empty cars were being placed in a room, the second car jumped the track at the frog and knocked out a prop set in the Y of the room switch; the derailed car was pulled onto the track, and the trip rider was standing near the place where the prop was knocked out when the slate fell.

The report does not state whether the derailment, which may be considered the direct cause of the accident, was due to dirty roadways, defective car or track, or some other cause. Possibly the roof may have been timbered with crossbars, instead of props, set along the roadway where they are likely to be knocked out by a derailed car. All employees, regardless of where they are working, should be cautioned to keep from under places where timber has been accidentally knocked out until the roof has been retimbered or taken down; particularly is it desirable not to stand under a place immediately after the support has been knocked out.

Fatality 5

A shot firer was asphyxiated by noxious gases given off by black blasting powder.

The report on this fatality states that two shot firers had finished shooting in a section of the mine when one of them remembered he had failed to tamp a hole in one of the rooms. The deceased accompanied him to the room to assist in tamping the hole; while engaged in this work they were both overcome. Artificial respiration was performed on both, but one man could not be resuscitated.

When black blasting powder is used for blasting it is likely to give off carbon monoxide and other poisonous gases; and this, together with its well-known tendency to ignite easily and to cause dust or gas explosions makes black blasting powder in any form dangerous to use in coal mines. Shot firers or others working in a mine should not go into places to work immediately after shots are fired; they should wait until the smoke and noxious gases have been removed by ventilation.

Fatality 6

A tracklayer was killed by a fall of roof while laying track on a parting.

The report on this fatality states that the deceased sounded the roof, apparently thought it was all right, and started to lay the track, when a large chunk of slate fell from between two invisible slips, killing him instantly.

No mention is made in the report of the method used to sound the roof, but it is presumed that it was the one generally used by most miners of hitting the roof with a pick. If the piece of slate was large, this method of sounding the roof would not indicate its true condition, particularly if the slate contained invisible slips. Had the vibration method of sounding roof been used, doubtless the true condition of the slate would have been determined and props set to secure it. Since there is always a large expanse of unsupported roof on newly made partings, safety props should be used until the roof can be timbered otherwise.

Fatality 7

A timberman was killed by a fall of slate while cutting a hitch in the rib.

According to the report on this fatality, the roof was bad at this place and the weight was gradually turning over an I-beam support. It was the intention to set an I-beam on each side of the defective beam; while the timberman was cutting a hitch in the rib about 2 feet from the defective beam the weight swung 4 other I-beams, permitting a large quantity of slate to fall, killing the timberman instantly.

No statement is made in the report as to whether the roof and timbering were examined carefully to determine the true condition of the place; this should be done at all times under such conditions. Accident records of the mining industry show that a number of timbermen, as well as some other underground employees, have been killed in this way; all companies should adopt a system of using temporary safety props when setting timber under dangerous roof conditions, the safety props to remain in place until the permanent timber has been set and the place made safe.

Fatality 8

A rockman was killed by a fall of slate while cleaning rock off the coal in a room face.

The rockman working with the deceased started to pull down a "pot" rock in the room where the accident occurred. The deceased sat down about 12 feet from the rock; his buddy asked him to sound the roof above him, which he did. He said it was safe; when the rock fell it broke the slate over the deceased and crushed his chest.

Accidents from this cause are not infrequent in coal mines; in pulling down loose slate which sounds solid and is apparently safe, the supposedly solid material will rip and fall with slate that is known to be loose. When loose slate is being taken down, all other underground employees near the loose material and not assisting in this work should retire to some point supported by timbers or to a point where they know there is no likelihood that the slate will fall.

Fatality 9

A miner was fatally injured about 7:15 a.m. by a fall of rock and died about 11:30 a.m. the same day.

The report states that the deceased and his buddy were working in an entry; the mine manager had been in the place and told them to watch the roof and he would go to prepare another place for them. About 5 minutes after the mine manager left the place, some clod about 2 feet thick, 6 feet long, and 8 feet wide fell on the deceased; after the clod had fallen, a blind slip was exposed to view on the left rib.

Judging from the information contained in the report on this accident this piece of clod could and should have been timbered or pulled down before the men worked in the place. If the mine manager knew the place was in such a condition that he deemed it advisable to prepare another place for the men to work, he should have seen that the clod was pulled down or securely timbered at once or should have prohibited the men from working there before he left the entry. Numerous fatalities, as well as many serious nonfatal injuries, have occurred in Illinois and other mining States when foremen knew that men were working under loose roof, warned them of the danger, and told them to set props but left the place without seeing the instructions put into effect. When foremen find underground men working under dangerous roof they should insist that the workers either pull down the loose roof or timber it securely; if this is not done before they leave they should prohibit work in the place.

Fatality 10

A machine helper was fatally injured by a slate fall while shoveling cuttings at a room face that was being undercut.

The report states that the deceased had been instructed to take down the loose roof and watch the place. He had tried unsuccessfully to take down the piece that fell and, thinking the roof was safe, started to work under it. He had worked only a few minutes when the slate fell.

The report on this fatality, like that on fatality 9, indicates that telling a man to be careful will not prevent fatalities from this cause. Dangerous roof that cannot be taken down should be securely timbered; if it cannot be securely timbered or pulled down, it should be shot down.

Fatality 11

A machine helper was killed by a fall of face coal while shoveling cuttings at the face of a room being undercut.

According to the report on this fatality, the room face was "sounded" by the machinemen before they started to undercut the place and was considered by them to be solid; however, when they were almost through cutting the place about 2 tons of face coal fell, crushing the deceased against the machine.

Falls of face coal have been responsible for many serious and fatal accidents in Illinois, as in many other States with fairly high coal. Face coal that sounds solid before the place is undercut may contain slips or cracks from previous shots or due to cleats, and after the coal is undercut it may fall without warning. Many accidents from falls of roof can be prevented, if not eliminated, by systematic spragging of the faces while they are being undercut; in one Illinois mine which adopted this system no such accident has occurred since this precaution has been taken.

Fatality 12

A conveyor loader was killed by a fall of rib coal while pulling down coal at the face.

The report on this accident states that some loose coal on the rib had been left from the cut before the one being loaded out. The face boss had been in the place and told the loaders that the rib coal was dangerous and should be taken down. The loaders tried to pull the rib coal down but failed, claiming it was too tight; when some standing face coal was pulled down with a bar the loose rib coal fell with the face coal and killed the deceased.

Doubtless this loose rib coal was held in place by the face coal. If it was necessary to pull down the face coal first, sprag should have been set against the rib coal. However, a little work with a pick probably would have released the tight end and permitted the coal to fall without causing the accident. This accident, like some of those previously mentioned, indicates that it is not always sufficient for a foreman to tell an employee to make a dangerous place safe; he should require men working under dangerous conditions either to make the place safe or to quit working there.

Fatality 13

A cutting-machine operator was killed by a fall of rock while undercutting near the face of a room.

The roof in the place was "heavy"; the foreman warned the machine men about it and told them to be careful; they were given a set of tools and told to pull down all loose slate and to timber the place before starting to cut it. They moved two props and took down some slate but left loose slate at the face, which fell and killed the deceased.

Many accidents occur from falls of roof and coal because men rely too much on their judgment. Loose slate either should be pulled down or securely timbered and made safe before men commence to do other work; if foremen visit a place and see that it is dangerous, they should supervise the work of making it safe.

Fatality 14

A cutting-machine helper was killed by a fall of clod.

The machinemen had finished undercutting a crosscut in an entry and were loading the equipment on the machine to move to another place when the helper was killed by the fall of some clod 1½ to 7 inches thick, about 7 feet wide, and 8 feet long.

Although the report states that the roof was sounded before and after the place was cut, nothing is said of the method of sounding or the interval between the last sounding and the falling of the roof. The vibrations made by undercutting the coal tend to loosen the roof. If the ordinary method of sounding roof was used it may have sounded solid. If the vibration method had been used the true condition of the roof might have been revealed, indicating that it should be taken down or timbered. Too much stress cannot be laid on the necessity for using the proper method of testing roof, testing it often, and not placing excessive reliance on personal opinion as to the condition of the roof.

Fatality 15

One of the owners of a small mine was assisting the shot firer when he was fatality injured by a piece of rock thrown by a shot.

According to the report the shot firer had lighted the shot in the face of the entry and shots in the three rooms outby the face of the entry. The deceased was standing in the neck of the fourth room, about 120 feet outby the face of the entry, when a piece of rock thrown by the shot hit him on the leg above the ankle, breaking both bones. The report does not state whether the man died from hemorrhage, shock, or some other cause due to the injury.

Evidently the deceased was not as far from the shot as he should have been. The miner who prepared the shot stated that it had 4½ to 5 feet of fuse; if this was the case, the amount of fuse should have given the deceased plenty of time to retire to a safe place; those engaged in shot firing should be sure they are in a safe place when the shots are being fired.

Fatality 16

A miner was killed by a fall of slate.

Nothing is said in the report on this accident, except that the deceased was timbering in the entry when the slate fell; it is presumed that the roof was not properly tested to determine its true condition. Reports should be more explicit and give definite information regarding the conditions surrounding accidents and what the deceased was doing at the time of the accident; if this is not done it will be difficult to learn from accidents that have occurred how to prevent similar accidents in future.

Fatality 17

A clean-up man in a mechanized mine was killed by a fall of slate and top coal.

The report states that the place had a coal top and was timbered within 10 feet of the face and that two unseen slips in the roof near the face caused the roof to fall. The face boss was in the place a short time before the accident happened and reported that the roof sounded safe and the place was well-timbered. The machine had loaded three cars on the left side and several in the center of the place; he had started to load on the right side of the room. After some of the face coal on the right side of the place was released, the top coal and slate fell, exposing to view the two unseen slips.

While the information contained in this report indicates that the place was well-timbered and that the roof sounded "good" some time before it fell, it also shows the necessity for the systematic sounding of roof while the coal is being loaded. If the vibration method had been used and the roof carefully tested on the right side where the fall occurred before the loading machine started to operate, doubtless this loose roof would have been detected and provisions made either to pull it down or to timber it securely.

Some companies have adopted systematic testing of roof, using a combination of the sound and vibration method; they require loading-machine crews to test the roof in a room before the loading machine is operated and at regular intervals while the coal is being loaded. Since adopting this system and systematic timbering, they have greatly reduced accidents from falls of roof without reducing the output of the loading machines.

Fatality 18

A conveyor loader was killed by a fall of rock.

According to the report on this accident, the loader was switching a loaded car in a room with a mule. The car was off the track, and crossbars that had been supporting the loose coal were lying on top of the car; it could not be determined whether the car in jumping the track or whether coal on top of the car knocked out the crossbars. The fall of rock killed both the loader and the mule.

The report does not give information concerning the real cause of the accident. The crossbars supporting the roof may have been knocked out by the car jumping the track due to dirty roads or defective car; the crossbars may have been low and the car loaded too high, catching the crossbars and knocking them out; or the crossbars may not have been sufficient to support the weight on them, permitting the slate to fall when the car was being switched in the room. The information contained in the report indicates the need for more careful inspection of roof, timbering, rolling stock, and height of loaded cars when they have to pass under low crossbars; also, more information should be given as to the underlying cause or causes of the accident so steps may be taken to prevent occurrence of similar accidents.

Fatality 19

A loading-machine operator was fatally injured by a fall of rock while moving his machine back from the face of a room.

This fatality occurred in the afternoon; the room had been examined and found well-timbered and safe before the coal was loaded out, but a fault in the roof near the face caused the slate to break loose at the face. The falling material dislodged several timbers, causing slate to fall which crushed the deceased against the machine.

The place may have been well-timbered, but there is always more or less area of unsupported roof when loading machines are used, therefore the roof at the face should be sounded at regular intervals while coal is being loaded out.

Fatality 20

A miner died from blood poisoning from a cut about 1 inch long, which was made on the forearm by a small piece of top coal.

The report on the injury states that the deceased was taking down a piece of top coal about 8 inches thick when a small piece fell and hit him in the forearm. The foreman gave him first-aid treatment and told him to get to the doctor to have the wound treated and dressed when he reached home. The deceased finished the day in the mine and worked the following day. Five days after the injury occurred the doctor was summoned to treat the injury; it had developed a serious type of infection which became general, and death resulted 13 days after the injury.

It is essential to prevent small injuries, as well as those of a more serious nature; therefore, regardless of the kind of work being done care should be taken to prevent even small injuries. When small wounds are received they should not be neglected as was the wound which caused death in this case; deaths from infections among miners, due to the neglect of small and apparently insignificant wounds and scratches, are by no means few in number.

Fatality 21

While examining a local mine a miner was burned by a gas explosion and died the following day.

The report on this fatality states that the deceased was using an open light and ignited gas in an entry; his buddy warned him not to make the examination, as he was not a certified examiner.

Ventilation should be maintained in local as well as in larger mines so explosive mixtures of methane and air will not accumulate. Only certified examiners should examine mines, and it is very poor practice to use an open light when making a mine examination; it is true that the open light is a sure method of finding an explosive mixture of gas, but its use in testing often results in the death of one or more men, as well as in the destruction of property. Examiners should use only permissible flame safety lamps or other equally safe and effective gas-detecting devices, and if additional light is needed a permissible electric cap lamp should be provided.

Fatality 22

A miner was killed by a fall of rock.

At the beginning of the shift the deceased had placed two props under the rock at the face and continued to load coal until about 2:00 p.m. when the rock fell, killing him instantly; a coal slip was exposed in the roof by the fall of rock.

Doubtless loading out the coal had removed support from the rock; had this piece of slate been examined at regular intervals by the vibration and sound methods, its true condition would have been determined before it fell, and the deceased could either have pulled it down or set up additional props.

Fatality 23

A miner was killed by a fall of slate in a small local mine.

The deceased was a loader and the mine manager; at the time of the accident he was working in a room that had some draw slate, and a short time before the accident he had taken down all that he could, but apparently more became loosened and fell on him while he was loading a car.

Nothing is said in the report about the interval between the time the deceased pulled down the slate and when he started to load the car, although the report indicates that roof at the face should have been sounded often. Underground employees often try to pull down loose roof, and because it does not fall easily they think it will stay up for an indefinite period and will fail to set props under it or to keep testing it at frequent intervals; this has caused many fatalities in coal mines in Illinois, as well as in virtually all other States in which coal is mined.

Fatality 24

A timberman was killed by a fall of top coal in a room. The coal bed had taken an abrupt dip during the last machine cut, and as a result the shot holes were near the slate, leaving the top coal with a loose end at the face. The deceased and his buddy were setting props in the place when the roof coal fell; the fall exposed a slip at the face.

The report contains no information regarding the distance of the props from the face or whether the roof at the face had been tested carefully before the deceased and his buddy started. Several of the foregoing paragraphs on fatalities due to falls of overlying material indicate that after the fall slips were exposed at the face; this shows the necessity of all underground employees exercising the greatest care in safeguarding overlying material, even when it appears to be safe. Any roof that cannot be made safe by timbering should be taken down, and all roof should be timbered systematically, even when it seems solid and safe.

Fatality 25

While preparing to set a prop a miner was injured by a fall of top coal and died the following day.

The report states that the deceased was setting a prop near the face of a room; the prop was about 2 inches too long, and he was picking some of the top coal so that he could get enough height when the top coal fell. The report also states that the top coal in the room where the accident occurred was difficult to keep up.

Evidently the condition of the top coal was worse than the deceased realized, and the jarring due to hitting it with the pick caused it to fall more easily than it would have done otherwise.

The report does not say whether the roof was tested carefully, but if it had been tested carefully by the vibration method the looseness very probably would have been indicated. When it is difficult to hold up top coal in such rooms it should be taken down. If this cannot be done, crossbars used instead of single props probably will reduce the hazard in rooms with this kind of roof.

When dangerous roof must be timbered with single props which are not of the proper length, the distance should be measured and the props sawed to the desired length in a safe place; this would make it unnecessary to cut in the roof or dig a hole in the bottom to accommodate the props, thus reducing the time to be spent under the loose roof, as well as eliminating unnecessary jarring.

Fatalities 26 and 27

A loader and a timberman were killed by a large fall of slate.

How near to the face props were set in this place or how carefully the roof had been tested is not stated in the report; it was known that the roof was "bad", as the timberman was called into the place by the deceased loader and his buddy to make it safe. The two men went into the side of the room to learn, if possible, whether or not the roof was working; while they were listening a large fall occurred, killing both men instantly. After the fall of slate occurred a slip was observed along one side which caused the slate to fall suddenly.

The information in this report again indicates the necessity of carefully testing and timbering rooms and using the greatest precaution, particularly where the roof is known to be likely to contain slips; evidently these two men erred in their judgment and advanced too far under the roof before sounding and listening.

Fatality 28

A miner was killed by a fall of slate while loading coal at the face of his room.

There was a "horseback" across the face at the edge of a fall of coal, and the deceased had been pulling down coal from the face and loading it into a car. His buddy told him to set some safety props; he had set one prop, which was not enough, and continued to load coal when the slate fell, killing him instantly.

"Horsebacks" are likely to contain slips and are extremely dangerous to work under; they should be tested at regular intervals by the vibration method and when possible should be taken down if they show indications of being loose. If they cannot be taken down they should be securely timbered immediately. The hazard from "horsebacks" in the roof would be reduced if the foremen would require a system of timbering to support them.

Fatality 29

A conveyor loader was killed instantly by a fall of slate.

The report states that the deceased and his buddy were loading coal on a conveyor when a piece of conglomerate material about 5 feet long, 4 feet wide, and ½ to 4 inches thick fell, killing him instantly.

The report does not say whether the roof had been sounded before or after the men started to load the coal. There is always more or less vibration during the operation of conveyor loaders or other mechanical loading devices which might cause loose roof to fall before it would otherwise do so. The noise of the machinery also prevents employees from hearing a loose piece of material when it is "working" and about ready to fall. Loaders should be required to stop mechanical loaders at regular intervals and sound the roof carefully; if it is loose the roof either should be taken down or securely timbered.

Fatality 30

A trip rider was killed by being crushed between two cars.

The deceased was working on the night shift and had worked only three shifts at this mine when the accident occurred. The motorman and trip rider were delivering material and had pulled their trip into a room to permit the main-line locomotive to pass. Thinking the last car of his trip was in the clear, the deceased signaled the motorman to stop and was standing near the outby end of the last car when the main-line trip started out. The locomotive of the main-line trip, being narrower than the cars, passed the deceased, but he was caught between the car of coal and car of material and killed almost instantly.

Apparently, the deceased was a victim of mistaken judgment as to the amount of clearance necessary for the trips to pass. He was also standing at a very hazardous place and doubtless could have stood elsewhere and avoided the accident. Nothing is said in the report regarding instructions to the deceased as to how he should perform his work or the hazards connected with it. New men unacquainted with the haulageways, rolling stock, and methods of working at a mine are more or less liable to be injured; therefore it is good mining practice to give all new men instructions regarding their work. One company did this in 1933, and the accident rate among new employees was much lower than it was among the older ones.

A rule should be adopted and enforced in all coal mines stating how far the last car of a trip should be from the frogs or straight-line track to permit sufficient clearance, even though an employee should be standing at the end of a car as the deceased was in this case. The railroads have had many accidents from this cause and as a result now place posts in the angle between the straight and spur tracks to show where cars should be placed to permit sufficient clearance.

Fatality 31

A shot firer was killed by a fall of face coal.

According to the report on this fatality the deceased was shooting with a battery; he had fired the shots on the right side of the room and was attaching the shot-firing cable to the leg wires of a shot on the left side when the face coal fell, killing him.

Falls of face or rib coal are responsible for the death of many employees; shot firers and other employees working near the face of rooms or entries should examine the coal carefully before starting to work, as well as at intervals while at work.

Fatality 32

A miner was electrocuted in a mine. The report states that the deceased with his brother was laying a pipe line when the former came in contact with live wires and was electrocuted; the wires were insulated and fastened to a board which crossed the entry, and the floor was damp at the place where the accident occurred.

The report indicates that the insulation on the wires was not sufficient to prevent electric shock or was broken and unguarded in places on the wires. Often the insulation on electric wires, particularly weatherproof insulation, is not sufficient to prevent electric shock, therefore little reliance should be placed on insulation alone. Nothing is said in the report as to the part of the body that came in contact with the wire. Many cases of electrocution have been prevented by employees wearing insulated safety caps; insulated safety shoes also will prevent accidents of this kind and should be worn by all employees, particularly those working around electrical equipment. Underground power lines should be much more definitely protected or safeguarded from contact with persons than they now are in most mines.

Fatalities 33 and 34

Two men were killed by falling down a shaft.

They were helping to retimber a shaft when the scaffold on which they were working broke; both fell about 150 feet to the bottom of the shaft and were killed instantly. Examination of the lumber of which the scaffold was constructed showed that it was defective.

Lumber used for scaffolds in retimbering shafts or any other kind of work should be selected with the utmost care to prevent similar accidents. Some companies refill the shaft with ashes or similar material to the point to be retimbered, then remove the ashes as they retimber.

Fatality 35

A miner was seriously injured by a fall of bone coal and died 24 days later.

This fatality occurred in a mine where a layer of bone coal 12 to 15 inches thick was left for a roof. The place was examined about 6:00 a.m. and reported in good condition; the accident occurred at 9:00 a.m. The deceased was preparing to set a prop under the bone coal when it fell, injuring his right hip and leg; infection developed in the wound, causing his death. After the roof had fallen it was observed that it contained a slip at the face.

Although nothing is said in the report as to when or how the roof was examined, it is presumed that the deceased knew it was loose, or he would not have been preparing to set a prop. However, the information in this report again indicates the necessity of examining roof carefully, and taking the roof down if it cannot be timbered safely. The wound infection may have been caused by careless and improper first-aid treatment; all injuries in which the skin is broken, whether large or small, should be treated as soon as possible to prevent infection.

Fatality 36

A loading-machine helper was killed by a car which ran over the end of the track, crushing him between the car and the face.

The duty of the deceased was to work at the face of a room. The loading machine had "cleaned up" the left side of the room and was moving to the right side; while the loading machine was moving to the right side the motorman pulled the trips of two cars, one of which was being loaded and contained about 1,200 pounds of coal, toward the mouth of the room so they would be out of the way of the loading machine. After the loading machine had been moved to the right side the motorman started to push the empty trip to the machine to finish loading the car. When the motorman started to push the trip downgrade to the room face it became uncoupled from the locomotive, and two cars ran over the end of the track to the face, a distance of about 20 feet, catching the deceased between one of the cars and the face.

The report does not say whether it was a defective coupling or something else that caused the cars to become uncoupled from the locomotive; if a defective coupling was the cause it indicates that a closer inspection should be made of the couplings. When cars are being placed in rooms going downgrade, all employees should be prohibited from working at the face in direct line with the track; as a precautionary measure, under such conditions, a substantial block should be placed near the end of the track and allowed to remain there until it is determined that the motorman has control of his trip.

Fatality 37

A miner was killed by a fall of slate while loading a car.

The report on this accident states that the deceased was working under roof that he knew to be dangerous and had informed a miner working in an adjacent room that he was going to set some props after he loaded a car or two, but the slate fell and killed him before the coal was loaded.

Mining history is replete with records of fatalities of employees who were going to timber slate or take it down after they had loaded a car or two, or did some other work, and as in this case the slate fell and either killed or seriously injured them. All underground employees who think or know that roof is loose should either timber it or pull it down before doing any other work.

If foremen observe men working under or near dangerous roof they should insist that the men either pull down the loose material or make it safe by timbering it before leaving the place. A "word of warning" is not sufficient, as it is often ignored, and hundreds of coal miners have gone to their graves through having ignored suggestions or orders of foremen or through having deferred compliance with suggestions or orders until some more convenient (future) time.

Fatality 38

A conveyor loader was killed by a fall of top coal.

He and his buddy were preparing to leave the face of an entry to load coal in another place and were loading their cable and tools on the conveyor when the top coal fell, fracturing the skull of the deceased. The roof in this section of the mine was very bad and contained many slips; however, the roof was good at the face where the men were loading, but a piece fell from a layer of top coal which extended from the face over the conveyor.

The report did not say how long it had been from the time the roof was sounded until the top coal fell; all roof, particularly that containing slips where loading machines are used, should be tested at regular intervals by the vibration and sound methods. If the loose roof cannot be taken down, some system of timbering should be adopted to support it.

Fatality 39

A company man was killed by a fall of slate.

A timberman had placed supports within about 3 feet of the piece of slate that fell. The deceased and his buddy sounded the roof before they started to work and reported it solid; the face boss was in the place about noon, sounded the roof, and said it was solid. The slate fell about 2:05 p.m., and it required several men to remove the slate from the deceased. The report does not indicate the distance between the last row of props and the face or the method used to sound the roof, but, if the roof had been sounded more frequently and the vibration method used, the looseness of this slate probably would have been detected. All underground workers should use the greatest care in testing roof, particularly when working at or near the face, where the largest percentage of mine employees are injured.

Fatality 40

A machine operator was electrocuted when his neck came in contact with a trolley wire.

The deceased and his helper were running the cutting machine into a room switch. The helper was attending to the machine cable, which was detached from the power line; the deceased was sitting on the machine, probably looking back to see if his helper had attached the machine cable to the feed wire, when he touched the trolley wire with the back of his neck. His helper immediately pulled the cut-out switch on the trolley wire, summoned help, and started artificial respiration which was continued for 2 hours and 40 minutes without response from the victim.

Too much care cannot be exercised by employees working around electrical equipment, particularly unguarded, uninsulated wires, such as trolley and machine power lines; mine managements should make every effort to guard such wires. The United States Bureau of Mines recommends[3] that "trolley and other bare wires should be adequately guarded wherever the wire is less than 6½ feet above the level of the top of the rail." In recent years fatalities and shocks from bare electric wires have been one of the principal causes of accidents in coal mines. Many mining men believe that guarding the trolley or bare power lines at intersections where men pass under them is sufficient protection, but there have been many fatalities from unguarded, bare, electric wires at points where haulage crews or other employees have come in contact with them while rerailing or uncoupling cars, or for some other reason. Companies that have installed and maintained guards for trolley wires throughout the trolley haulage roads have been repaid in the reduction of accidents caused by contact with trolley wires.

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[3] Decision 24, Recommendation of the United States Bureau of Mines on Certain Questions of Safety as of February 3, 1933: Inf. Circ. 6732, Bureau of Mines, July 1933, p. 36.

Those who administered artificial respiration to the deceased are to be commended although their efforts were unsuccessful; however, many lives have been saved by men who knew what to do in such accidents and were able to give artificial respiration immediately; therefore, all men working in and around mines should be trained in first aid.

Fatality 41

A conveyor loader was killed by falling face coal.

According to the report on this accident the deceased and his son were loading coal on a conveyor. Evidently the deceased was loading the loose bottom coal underneath the standing face coal when a large piece of the latter, weighing 3 or 4 tons, fell and injured him so badly that he died about 12 hours later.

Falling face coal has caused many similar fatal accidents in Illinois. While visiting different mines in the State the writer has observed miners first loading the bottom coal from under the standing face coal and then letting the top face coal fall over en masse; this is poor mining practice and will continue to cause accidents in mines as long as it is followed by the miners and permitted by the management. The top face coal should be pulled down first instead of being undermined by loading out the bottom coal; miners who follow this practice do not have accidents similar to the one that caused this fatality. If it is necessary to undermine the standing face coal, it should be spragged properly until the undermining has been completed.

Fatality 42

A driver delivered a trip on the parting, unhooked the tail chain, and was in the act of coupling the moving cars when his head was caught between 2 cars and crushed so badly that he died in the hospital about 8 hours later.

Coupling moving cars has been responsible for many fatal and very serious nonfatal coal-mine accidents; it is a practice that should be discontinued in all mines. When the cost of accidents and delays caused by this practice is considered it is found to be very uneconomical. Some mining companies in Illinois prohibit the practice and state that they produce at least as much coal by coupling the cars when not in motion as they formerly did when coupling "on the fly".

Fatality 43

A miner was killed by a fall of slate.

The room was reported in excellent condition; the deceased wedged off a small piece of coal at the face and had started to examine the roof when the slate fell, killing him instantly. A blind slip was exposed by the slate fall.

Whether the piece of slate that fell was supported by the "chunk" of coal wedged off the face, or whether it was a piece of slate some distance from the "chunk" of coal, is not stated in the report; neither is it stated how carefully the roof had been tested before the accident occurred. If the roof had not been examined properly the jarring produced by wedging may have caused the slate to fall. However, the information in this report, like that in several of these reports, indicates that roof should be tested carefully and often, particularly roof that is known to be likely to contain slips, rolls, or "horsebacks."

Fatality 44

A timberman was killed by a fall of slate. The report on this accident states that the entry on which the fatality occurred had been standing idle for about 6 years; as a result of this period of idleness considerable slate had fallen; and the deceased, with some other employees, was "cleaning up" the slate and retimbering the entry. The deceased was standing on some fallen top coal trying to pull down a piece of loose slate when a piece above and behind it fell and killed him.

Evidently the deceased misjudged the condition of the slate above the piece he was trying to take down, otherwise he would not have tried to pull down the slate with the loose roof behind him.

This report also indicates that roof should be tested carefully. When entries have been standing idle for a long period and the conditions are similar to those existing on this entry they should be retimbered, if possible, before the greater part of the slate is cleaned. This can be done by first loading enough slate along the ribs to set legs on which a crossbar can be placed; after the crossbar is properly lagged, forepoled lagging can be used to a point where it is necessary to set additional crossbars.

Fatality 45

A loader was killed by a fall of face coal.

A loaded car in the room had been pulled, and the motorman was returning with an empty. The deceased was pulling down loose coal on the right side of the room with a pick. He had finished picking and was walking toward the center of the room when about 1,000 pounds of face coal fell, partly covering him. The report states that the condition of the room was good, the roof being solid with no slips visible. Doubtless the face coal was loose in the center of the room, and when the deceased started to pull down coal on the right rib with a pick the jarring from the blows of the pick caused the coal to fall.

Accident reports show that many fatal and very serious nonfatal accidents have been caused by falling face coal; therefore care should be used when working around standing face coal or ribs near faces; the coal should be tested carefully and, if loose, pulled down if possible; if this cannot be done, the coal should be spragged until it can be taken down.

Fatality 46

A miner was snubbing bottom coal in a room when he was killed instantly by a fall of face coal.

The above is all the information contained in the report; however, the cause of the fatality again indicates the necessity of carefully testing and spragging the faces, particularly after they have been undercut.

Fatality 47

A trip rider was killed by being crushed between the cars and rib.

This accident occurred during the night shift. The motorman and trip rider had finished their shift and were en route to the shaft bottom; as they went around a turn onto the main entry the deceased tried to pull out a cut-out switch on the trolley line but missed it. He then jumped off the locomotive on the inside of the turn where the clearance was insufficient and was crushed between the car and the rib.

Since this accident the company has issued orders to all motormen to bring their locomotives to a full stop before a trip rider pulls a switch on the trolley lines. Compliance with this rule will prevent similar accidents in the future; however, where possible, enough clearance should be provided on the inside of the turn as well as on the outside.

Fatality 48

A mechanic was scalded so badly he died a short time afterward.

The mine where this accident occurred had been idle for 2 or 3 days while repairs were made to the hoisting engine. The repairs had been completed and the steam turned onto the engine for about 5 minutes by partly opening the main steam valve. The deceased went to the basement of the engine room to remove a wedge holding the engine brake when the throttle valve burst; he was caught in the escaping steam and scalded so badly that he died within a short time.

The blowing out of this throttle valve may have been caused by stresses set up by the unequal expansion of the metal. To prevent similar accidents the company intends to set the engine in a neutral position use a release valve and pass the steam through the pipes and cylinders to let them heat before the full head of steam is made available to operate the engine.

Fatality 49

A miner was killed by falling down the shaft.

The report on this accident states that the deceased was coming up out of the mine on the cage when for some reason he released his handhold and fell back between the cage and shaft timbers; there were seven other men on the cage with him, but they did not see what happened until they heard the noise caused by the body rubbing against the shaft timbers.

What caused the deceased to release his handhold while on the cage is not known as those on the cage did not see him at the time. All men riding on cages should be cautioned to retain a firm handhold until the cage stops; preferably all cages should be provided with doors or gates which should be kept closed at all times when the cage is in motion.

Fatality 50

A driver was kicked in the abdomen by a mule and died 14 days later.

The report on this accident states that the deceased was taking 2 empty cars into an entry and intended to switch 1 into a room. He reached down to unhook the tail chain from the car when the mule kicked him.

The report does not state whether this mule was what is known in mines as an "outlaw", but if it was it should have been taken out of the mine. However, as men have been killed by being kicked by mules that had worked in the mines many years and were considered gentle and trustworthy, all drivers and others working with or around mules should be very careful to stay out of reach of their hind feet as much as possible, and entries and other places in which mules work should have sufficient clearance so that the driver is not compelled to keep continually in close proximity to the mule.

Fatality 51

A trip rider was caught between two loaded cars while trying to couple cars in motion, the second fatality during the year caused by attempting to couple cars while in motion.

This practice is hazardous as well as expensive and should be discontinued.

Fatality 52

A conveyor loader was killed by a fall of face coal.

According to the report on this accident the deceased and his buddy were loading coal from a break-through onto a conveyor from the second cut in the break-through. The coal on the left rib of the crosscut where the deceased was working was shaped somewhat like a horseshoe, therefore there was loose coal in front and behind him, and it contained some slips. The deceased had pulled down some loose coal, and he and his buddy had started to shovel again when more fell.

This is another fatality to add to the evidence that judgment alone will not prevent accidents from falling face coal. Face coal should be tested carefully and often by vibration and sound methods. Foremen can be instrumental in preventing many accidents from this cause by insisting that face workers test carefully the face coal around which they are working, and if the coal is loose either pull it down or sprag it securely.

Fatality 53

A conveyor loader working in pillar work was killed by a fall of slate.

The report states that the pillar work was "good" in the section where this accident occurred. The roof was rock and sounded solid not long before the accident occurred; the rock that fell was about 4 feet square and 4 inches thick and did not contain slips.

The report on this accident gives no information as to whether the place was well-timbered or as to the interval between the time when the roof was tested and when it fell. Information in the report, however, indicates that too much confidence cannot be placed on the appearance of a working place in a mine, and because roof may sound solid at one time it will not necessarily remain solid for an indefinite period; there is always more or less weight on the roof in pillar work, and as a rule it is considered more hazardous than working in the faces of rooms, although some companies produce considerable tonnage from pillar work and have very few accidents. The roof in pillar work, as in any other working place, should be tested carefully and often and kept well-timbered.

Fatality 54

A motorman was electrocuted by contacting the resistance of a locomotive.

The deceased and the trip rider were cleaning the roadway, each loading in a different car. The deceased had finished loading his car and sat down on the locomotive while waiting for the trip rider to finish loading. While sitting on the locomotive he came in contact with the unguarded resistance. He was taken to the top and artificial respiration applied and continued until the doctor arrived. Had artificial respiration been applied as soon as the deceased was removed from contact with the resistance, he might have revived. All employees working in and around mines, particularly those working on electrical equipment, should have first-aid training and be instructed in the proper procedure in such accidents.

Since this accident the company has placed guards on the resistance of the locomotives, which will prevent similar accidents if the guards are kept in place. This accident indicates that all bare uninsulated conductors of electricity, around which men are required to work, should be well guarded in all mines.

Fatality 55

A miner was fatally injured by a fall of slate and died the following day.

He was working in a gang setting a cutting machine to undercut a place when a piece of rock fell, striking him on the back of the head and knocking his head against the machine.

Judging from the recommendation in the report the deceased was anxious to cut the place and failed to test the roof carefully. It is believed that all employees working at the face, irrespective of occupation, should take time to test the roof carefully and, if they find any loose slate, either pull it down or timber it. Roof should also be tested carefully at regular intervals while men are working in a place.

Fatality 56

A motorman was killed instantly by being run over by a locomotive.

He was en route to the shaft bottom with his locomotive at the end of the shift when he ran into another locomotive ahead of him and was knocked from his locomotive, which passed over him and killed him instantly.

Whether the other locomotive had stopped or the deceased was running at a high rate of speed is not stated in the report. However, judging from the report the deceased was apparently running his locomotive too fast; this is poor practice, particularly at the end of a shift when employees are anxious to get out and are under more or less of a nervous strain. Many accidents occur under these conditions, and in general the fault is due to poor supervision; nothing is gained by being in a hurry, for if all of the men arrived at the shaft bottom at the same time only a certain number could be hoisted on the cage, and the others would have to await their turn. Mine foremen should set a safe and reasonable speed limit for the operation of locomotives while en route to the shaft bottom at the end of a shift and should see that motormen do not exceed it. A company in Illinois, because of a similar accident, adopted a rule that all locomotives not used for man trips should be coupled together and the locomotive trip taken to the bottom by one motorman.

Fatality 57

A miner was killed by a fall of slate.

He and his brother were loading a car when slate from a "horseback" which contained some slips fell and fatally injured the deceased, death resulting 4 days after the accident; his brother stated that they knew the slate was loose and intended to set two props after the car was loaded.

This is at least the second fatality during the year caused by failure to take down or timber slate although the miners knew the slate was loose but deemed it safe to load a car first. Similar accidents will occur as long as men take such chances and are permitted to do so; any miner or loader found working under loose roof and indicating that he would timber after his car was loaded should be severely disciplined.

Fatality 58

A company man was killed while delivering powder to the face workings.

According to the report on this accident the deceased was delivering powder on the night shift with a mule and was going through a curtain when his light was extinguished. A "horseback" projected down from the main roof about 12 feet from the curtain, the lower part being 52 inches above the rail and 12 inches from the top of the powder car. After passing through the curtain he raised up, and his head was caught between the "horseback" and car; his spinal cord was severely injured, and death occurred the day after the accident.

Where rolls, "horsebacks", or other sudden breaks occur in roof on roadways used for haulage purposes and constitute a hazard, they should be taken down. Had the deceased been using an electric cap lamp he would have retained his light after he passed through the curtain and probably could have seen the "horseback"; curtains constitute more or less of a hazard on haulage roads in coal mines, and wherever possible doors or brattices should be substituted.

Fatality 59

A cutting-machine helper was killed by a flying bar knocking him into the machine bits. Presumably the machine operator and the deceased were undercutting a place with a breast machine, were preparing to make the second cut, and had placed an iron bar between the cutter head and the coal. After the machine had been started the deceased asked the operator to stop the machine, as he wanted to change the cutter head; after the cutter head was changed the machine was again started, when the iron bar flew out and knocked the deceased into the machine bits.

Probably the machinemen were moving the machine into place with the power when the bar flew out and knocked the helper into the bits. Many machinemen have been injured or killed by this practice, and it should be discontinued; it may be more work to move the machine with a bar, but it is less hazardous.

Fatality 61

An apprentice miner was killed by falling face coal.

The report states that the deceased was loading coal in an entry when a large chunk from a standing shot rolled over and killed him. The mine manager was in the place and had sounded the coal; he reported it solid and apparently safe to work near by.

Evidently this piece of coal was not properly tested; often a large "chunk" of coal may sound solid when hit with a pick, but if the tips of the fingers are placed on the chunk and it is hit lightly with a pick in the other hand (this is known as the vibration method) the indication may be that the chunk vibrates, hence is loose and dangerous and should be pulled down, although it does not sound "hollow".

Fatality 62

A trip rider was killed by being run over by a loaded trip.

The haulage crew had delivered a trip of empty cars on the parting but had failed to observe whether the marker on the last car of the trip when it left the shaft bottom was still on the car when the trip was placed on the parting. Four empty cars had become uncoupled from the trip and were standing in a sag on the main haulage road. Members of the haulage crew en route to the shaft bottom were going downgrade with the loaded trip when they observed the empty cars about 250 feet ahead of the locomotive; the deceased jumped off the locomotive and was killed by the loaded trip, the motorman finding him behind the trip.

The purpose of markers on the rear end of haulage trips is to indicate when part of a trip has uncoupled; this is a safeguard for all employees working on or around haulageways, particularly for motormen and trip riders, and they should see that the markers are on the trips when they are delivered to the partings and shaft bottom. Some companies have a red storage-battery light for a marker. When placed on the rear end of empty trips these lights in some instances stand above the tops of the cars so that the motormen can see them at all times. These trip lights are recommended highly by motormen who use them.

Fatality 63

A coal miner was killed instantly by a fall of slate in a small mine.

The deceased and his buddy, who was also the mine manager, were working in a room; after firing a shot and waiting for the ventilation to remove the smoke, they had gone back to the face of the room and started to pull down some coal when the slate fell and killed the deceased instantly.

Apparently neither the deceased nor his buddy tested the roof before they started to work at the face; all miners, regardless of the condition of the roof, should always test the roof carefully after shots have been fired, and if there is any loose roof they should either pull it down or timber it securely.

Fatality 64

A miner, who was also the mine manager, was killed by a fall of slate while opening a new mine.

The entry where the accident occurred had been driven about 40 feet. The deceased had been cautioned about the roof but went to work under it regardless of the cautions; he was shoveling coal from the face when a piece of slate about 4 feet wide, 6 feet long, and 10 inches thick fell and crushed his spine.

It is regrettable that mine officials will take such chances with loose roof; loose roof is no respecter of persons, and regardless of a man's occupation at the mine the roof should be tested carefully and often.

Fatality 65

A timberman was killed by a fall of slate.

The deceased and his buddy were preparing to put up two sets of timbers in an entry, and it was reported that the roof sounded fair; both men were digging holes in the ribs for legs when the slate fell on the deceased.

Since the deceased and his buddy were making preparations to timber this slate with crossbars, it is evident that the slate was loose. Although the report does not state what method was used in testing the roof, it is probable that had the roof been tested carefully by the vibration method the indication would have been that the roof was dangerously loose instead of "fair" and that safety props should be set. A number of timbermen have been killed by similar accidents which could have been prevented by setting safety props in the center of the entry until the crossbars were in place.

Fatality 66

A trip rider was killed when his head was crushed between a prop and a car.

The report states that the deceased was switching a loaded car from one room to another; while throwing a switch he fell and caught his head between a prop and the car which crushed his skull, killing him instantly. The prop was 17 inches from the rail and 3 inches from the side of the car; plenty of space was available, and the prop could have been set far enough from the rib to allow sufficient clearance.

The report does not say what caused the trip rider to fall; it may have been coal or some other obstruction on the roadway; whatever it was should be considered the principal cause of the accident and removed. The prop undoubtedly was a contributing factor; all mines should have standards specifying that props or other obstructions be placed so as to allow sufficient clearance from the widest piece of rolling stock.

Fatality 67

A miner was killed by a fall of slate.

He and his buddy were working in an entry and turning rooms as the entry advanced. They had finished loading a car in the crosscut of a room; the deceased obtained powder and started to the face of the entry to tamp some holes; when about 14 feet from the face, the slate fell and killed him. The entry was timbered within 15 feet of the face.

This accident, like many others mentioned, indicates that roof should be sounded carefully and often. Doubtless this accident would have been prevented had the timbers been maintained nearer the face and safety props used. Mine management should adopt systematic timbering and at all times maintain the prop line as near the face as possible.

Fatality 68

A car dropper working on the surface was killed by being crushed between a loaded railroad car and the scalehouse.

The loaded cars at this mine are weighed automatically by passing them over a track scale as they run by gravity from the tipple to the storage yard. Clearance between the railroad cars and the scalehouse was insufficient, and the car droppers had been warned of this fact. The deceased was riding a loaded car from the tipple to the storage yard, and as it approached the scales he saw that the car he was riding was going to strike one that had stopped partly on the scales. When he saw the crash was inevitable he crossed over to the side of the car where the step was located, on the scalehouse side, evidently with the intention of getting off, forgetting that there was not enough clearance, and was crushed between the car and the building.

Since this accident the company has moved the scalehouse to allow enough clearance; the question of clearance should be given due consideration at all mines when buildings are being constructed alongside railroad tracks, and even when mistakes are discovered after construction it is far better to make necessary changes before than after an accident occurs.

Fatality 69

A loading-machine helper was killed by a fall of slate.

The coal had been loaded on the left side of the room, and the deceased was cleaning up the coal left by the loading machine when the slate fell; it was reported that the place was well-timbered, that a prop had been set under the slate that fell, and that the machine operator had sounded the roof some time before and found it solid. Moreover, the foreman stated that he was in the room about half an hour before the accident occurred and found it well-propped and apparently in good condition.

The time that elapsed between the last testing of the roof and the accident is not given in the report. If a prop was under the slate that fell, evidently it had been poorly set, or it was not large enough to support the slate; this accident also indicates that the roof, particularly where loading machines are used, should be sounded carefully and often and the rooms kept well timbered at all times.

Fatality 70

A conveyor loader was killed by being crushed between a car and the face.

At the time of the accident the deceased had loaded about 1,500 pounds of coal directly into the inby end of the car; as the room was going downgrade, and the rails were wet, a sprag was placed in each wheel on one side of the car and a scotch block in front of one of the wheels on the opposite side. Probably the coal in one end of the car caused it to upend and skid off the end of the track, crushing the deceased between the car and the face.

In loading cars in downgrade places it is not good practice to load the inby end of the car first, as the weight often causes the car to upend and run over the end of the track, particularly when the rails are wet; there have been many fatal accidents in Illinois mines in past years due to poorly blocked cars running over the end of the tracks in downgrade places and crushing the loaders between the car and the face. Mine managements should adopt a substantial method of blocking cars at the face so that they cannot get loose and cause accidents of this kind; numerous effective devices or methods are available for the prevention of such accidents.

Fatality 71

An operator of a small mine was killed on the main haulage slope by a mine car.

According to the report on this accident the track in this slope was in good condition, but rain had washed out the ballast under a tie about 6 feet inby the slope mouth. The engineer was hoisting an empty car, and probably the rope flipped under the end of the tie. The deceased and another employee were standing in a refuge hole and heard a noise similar to that made by a derailed car; as the noise increased the deceased stepped out of the refuge hole to signal the engineer to stop when there was a loud crash, the car broke loose, ran back, and caught the deceased before he could return to the refuge hole. The rope had a swivel near the hook, and the swivel pin was made of grey iron about three fourths inch in diameter; the pin had a flaw in it, which caused it to break when the rope caught under the tie.

Proper drainage should have been provided to prevent washing out the ballast under the ties near the mouth of the slope; also guards should have been placed over the ends of the ties where the rope flips about or enough ballast over the ends of the ties so that the rope could not catch on them. Judging from the information contained in the report, a cast-iron pin was used in the rope; the pin as well as the hook and rope should have been made of the strongest and toughest material available, and hooks, swivel, and ropes used for hoisting coal in slopes should be inspected carefully at regular intervals.

SUMMARY

Although the cause of each fatality and methods of preventing similar injuries in the future have been discussed in the review of Illinois fatalities for 1933, it may be worth while to discuss some of the contributory factors most frequently associated with the accidents.

The Illinois accident reports for 1933, like those for the 50-year period 1882 to 1932, inclusive, show that the majority of men were killed by falls of roof, sides, and face and by haulage accidents. Falls of roof were responsible for 36 (50.7 percent) of the 71 fatalities in 1933; falls of face and sides for 9 (12.7 percent); haulage for 13 (18.3 percent); and electricity for 3 (4.2 percent).

Falls of Roof

A study of the reports shows that some of the contributory causes for the fatalities from falls of roof were as follows: Failure to test the roof at regular intervals, failure to set enough props, and failure to use safety props, 21 fatalities; too much confidence in personal judgment as to how long roof will continue to be safe to work under, 6 fatalities; failure of foremen to require miners either to pull down or timber loose slate immediately, 3 fatalities (foremen had been in the places, observed men working under dangerous roof, instructed them to be careful or set props, and had then left the place); failure of miners immediately to set props under roof they knew was dangerous, instead of waiting to load a car first, 4 fatalities; and props of improper length and an unknown cause, each 1 fatality.

Failure to sound roof properly and at regular intervals or to set enough props, or failure to use safety props, has caused the greatest number of accidents from falls of roof; the fact that 21 (58.3 percent) of the 36 fatalities from falls of roof were due to these practices indicates that there must be a radical departure from them in the future if the accident rate from falls of roof is to be reduced.

Too often, accidents occur from falls of roof because foremen and workers place too much confidence in their own judgment as to how long loose roof will stay up before props should be set. There are too many variable factors in roof control, some of which cannot always be determined even with the best of roof, for either foremen or workers to depend solely upon their judgment; the fact that 6 of the 36 fatal accidents from falls of roof in 1933 were due to roof that sounded solid a short time before it fell is sufficient evidence that this is true.

Miners often fail to set props under loose roof when they want to do other work, such as loading a car or drilling a hole, which they consider more important at the time; this has caused the death of many miners in the past, and 4 men were killed in Illinois in 1933 by falls of roof when the deceased knew the roof was loose but was going to load a car before he set the props to secure the slate. Unsupported loose roof will fall, and the mining industry will continue to have fatalities therefrom as long as miners are willing and permitted by the management to work under such hazardous conditions. The proper time to timber or pull down loose roof is before other work is done, and all mines should require the systematic placing of timbers at certain stated intervals, with the definite understanding that when additional timbers are needed they should be set without delay.

When some foremen observe men working under dangerous roof they instruct them either to be careful or to set props and then continue on their tour of inspection; some reliable workers can be depended upon to comply with the instructions given by a foreman while others cannot. Three miners in Illinois were killed in 1933 by falls of roof a short time after foremen, who had observed them working under dangerous roof, had warned them to be careful or had instructed them to set props. The foremen should have required the men to make the places safe at once and should have remained until they did so. Until supervisors require men to make their places safe or stop working there, fatalities from this cause will continue.

By operating mines for a year without compensable injury from falls of roof, some Illinois mining companies have proved that these accidents can be prevented or at least greatly reduced in number.

The 36 fatalities were not caused by large, uncontrollable masses of roof but by roof that could have been timbered securely or taken down, which indicates that the prevention of accidents from this cause is not beyond the ability of the management and workers if they make a determined effort to control the hazard.

The following procedure, if adopted in all coal mines, would tend to reduce falls of roof accidents: (1) Systematic sounding of roof by the vibration method; (2) systematic timbering, applicable to each section according to roof condition and specifying the maximum distance props should be set from the roadside and face when the roof is good, additional props to be set when the roof is bad; (3) less confidence in roof that supposedly sounds good, and, instead, maintenance of the prop line as close as possible to the face and use of safety props near the inby end of the car or loading machine; (4) insistance by foremen that miners either securely timber dangerous roof, pull it down, or stop working in the place until it is made safe; (5) making miners realize that there is no way of determining how long loose roof material will stay up before props should be set and that it is essential that loose roof be timbered securely or pulled down before other work is done.

Haulage

In proportion to the number employed, more miners are killed by haulage than by any other one cause in the mine. During the 50 years 1882-1932, inclusive, in Illinois coal mines 1,111 men (approximately 18 percent of the total fatalities underground) were killed by haulage; in 1933, 13 men (20 percent of those killed underground) were killed by haulage, an increase of about 2 percent over the 50-year period.

The causes of the fatal injuries due to haulage in 1933 are essentially similar to those of preceding years. In 1933, 8 men were killed by mine cars, 2 by coupling cars on the "fly", 2 by locomotives, and 1 by a kick from a mule. Of the 8 men killed by mine cars, 1 was killed by a poorly blocked car and 1 by a car which uncoupled from the locomotive, in each case the car running back and crushing the deceased against the face; 4 men were killed because of insufficient clearance between the cars and the ribs, timbers, or another car; 1 was killed when he jumped off a locomotive and was run over by the cars; and 1 was killed when a slope hoisting rope broke, which allowed a car to run backwards, derail, and crush the deceased against the rib. Of the 2 men killed by locomotives, 1 was killed when his locomotive, which was traveling too fast while en route to the shaft bottom at the end of the shift, collided with another locomotive, and he was thrown under the wheels, and 1 was killed when the rear end of a locomotive on which he was riding was derailed by a "split" switch and his leg was crushed between the locomotive and ribs.

Although reports of Illinois and other mining States show that many men are killed or seriously injured each year by haulage, it certainly cannot be beyond the ability of the management of Illinois mines to eliminate or guard against such hazards as those responsible for the death of 13 men in 1933.

Insufficient clearance between the cars and the rib, timbers, or other cars was responsible for 4 deaths. If a determined effort is made, sufficient clearance can be maintained between cars and ribs or timbers, or other cars, in practically all mines, particularly at points where haulage crews are required to do the greater part of their work.

A poorly blocked car and failure to place a safety block on the track to keep cars from running back to the face caused 2 deaths. Proper blocking of cars on up and down grades is not given enough consideration in the majority of coal mines; in most mines small pieces of coal, cap pieces, or small pieces of wood are used for blocking cars; such blocks can be knocked out easily while the car is being loaded, allowing the car to run back to the face or out onto the entry either to kill or seriously injure a worker. The management and the worker should realize that poorly blocked cars represent a distinct hazard, more or less liable to kill or injure men, therefore only good, substantial devices or methods should be used to block cars on up or down grades.

Coupling cars on the "fly", responsible for 2 deaths, is an unnecessary practice; and when the cost of accidents, derailments, and other delays caused by the practice is considered it will be found that the economic loss is too great to permit the practice to be continued.

Two men were killed by locomotives. One was running his locomotive too fast en route to the shaft bottom at quitting time when it collided with another locomotive and he was thrown off and run over. The speed of locomotives can and should be controlled, particularly when en route to the shaft bottom at quitting time; the fact that the majority of workers are in more or less of a hurry to get out of the mine at the end of the shift indicates that greater care and rigid supervision and discipline should be exercised at this time to control the speed of locomotives and thereby prevent such accidents. The other man killed by a locomotive was caught between the locomotive and the rib when the rear end of the locomotive was derailed by a "split" switch. There is no good reason why switch throws should not be used at room switches, as well as at main-line switches; if switch throws were maintained in good condition at room switches, such accidents would almost surely be prevented.

That the greater number of haulage accidents can be prevented is indicated by the records of some Illinois mines as well as of some mines in other States. Some Illinois mining companies have greatly reduced haulage accidents by prohibiting such unsafe practices as coupling cars on the "fly", jumping on and off rapidly moving trips, and back poling and by insisting on such practices as securely blocking cars on grades, using switch throws at all switches (including room switches), maintaining good track with sufficient clearance along the haulageways, and keeping the roadways free from spillage and well lighted.

A company in another mining State operated a mine 43 months without a lost-time accident to the haulage crews. During this time they transported 1,080,733 tons of coal and worked 144,000 man-hours. If some Illinois companies, as well as some in other mining States, can operate mines with few if any lost-time haulage accidents, all mines in the State can be operated in that way if the proper time and effort are spent in solving the problems connected with haulage hazards.

Electricity

Electrical accidents have increased in late years, due largely to the rapid increase in the use of electricity in the mines; however, the hazard connected with the use of electricity can be controlled if desired. In 1933, 3 men were killed by electricity, of whom 2 contacted trolley wires and 1 the resistance of a locomotive. Such accidents as these can be prevented; the United States Bureau of Mines recommends that bare electric wires, around which men are required to work, should be well-guarded, and the resistances of locomotives should also be well-guarded. If close inspection is made of all electrical equipment used in mines, such as cutting, drilling, and loading machines, pump cables, switchboards, and switches, and the equipment is maintained in good, safe operating conditions, accidents due to electricity can be virtually eliminated.

Explosions

Although only one death was caused by gas explosions in Illinois during 1933 the explosion hazard always exists in mines which have explosive gas or dust; however, there is no reason why explosions cannot be prevented if the proper precautions are taken. Adequate ventilation, together with close inspection of the working places, old workings, and seals for possible accumulations of gas, are absolutely essential if explosions of gas are to be avoided. Some of the companies operating the largest and most gassy mines in the State maintain sufficient volume of air to keep the oxygen content above 20 percent and the methane content around or below 0.5 percent in the return air of each section. If this can be done in some of the largest and most gassy mines of the State, it can be done in all mines by having a suitable fan for the mine, clean aircourses, tight overcasts and brattices, and well-fitting trapdoors, together with reasonably efficient operating practices to keep these ventilating accessories in good working condition.

In recent years nonpermissible electrical equipment has been the source of ignition in many gas explosions, although the United States Bureau of Mines has been advocating for a number of years the use of permissible electrical equipment as a means of preventing the ignition of explosive mixtures of methane and air. If more equipment of this type was used the explosion hazard would be reduced, as users of permissible equipment claim that because of its more rugged construction and larger motors it gives better efficiency with less maintenance than the nonpermissible type.

Many coal-dust explosions, as well as mine fires, in the past have been caused by the use of black blasting powder; such explosions and fires can be prevented by the using permissible explosives as recommended by the United States Bureau of Mines. The use of rock dust in all coal mines will prevent the propagation of an explosion, once the explosion has started, if enough of the dust is applied to the passageways and the incombustible content is maintained between 60 and 70 percent, depending to some extent on the percentage of gas in the return air, the volatile ratio, and the fineness of the dust of the coal seam being worked.

In the foregoing summary only some of the principal causes of accidents in Illinois mines have been discussed, but enough evidence has been presented to show that at least a large percentage of the accidents from these causes can be prevented. The hazards that caused the least number of fatalities, as well as those that caused the greatest, can be guarded against or eliminated if the management and workers desire to do so.

CONCLUSIONS

The first essentials in accident-prevention work are to make a close study of the work to be done, recognize the hazards instead of ignoring them, and if possible either to eliminate the hazards or guard against them before accidents occur.

Any accident, whether or not it causes an injury, should be investigated thoroughly; the fact that one or more employees are not injured when an accident occurs only means that no one happened to come in contact with the forces at the time.

An accident that has occurred may be considered past history, as anything that is done afterwards can at best only to a very limited extent alleviate the suffering of those injured or reimburse the company for property damage caused by the accident. Therefore, after thorough investigation of an accident, a report should be made giving the underlying causes (of the accident, not of the injury) to prevent similar accidents in future. In most instances the cause of an injury is evident, but it is not always easy to detect and correct the cause of the accident responsible for the injury, which must be done if similar injuries are to be prevented.